

## **MANAGING THE RATE OF DELIVERING PERFORMANCE INTERVENTIONS IN A CONTACT CENTER**

### **CROSS REFERENCE TO RELATED APPLICATIONS**

5                   This application is a continuation in part of U.S. patent application Serial Number 10/602,804, filed June 24, 2003, which is a continuation of U.S. application Serial Number 09/442,207, now U.S. Patent Number 6,628,777, entitled "Method and System for Scheduled Delivery of Training to Call Center Agents," issued September 30, 2003.

10                  This application is related to U.S. Non-Provisional Patent Application, serial number unassigned, entitled "Managing the Selection of Performance Interventions in a Contact Center," filed December 11, 2003 and having attorney docket number 07117.105017.

### **15    TECHNICAL FIELD**

                  The present invention relates generally to contact centers, such as call service centers, and more specifically to managing the rate of delivering performance interventions, such as training sessions, for agents in a contact center.

### **20    BACKGROUND OF THE INVENTION**

                  A contact center, such as a call center, is a system that enables a staff of agents to service telephone calls to or from customers or other constituents. Modern contact centers generally incorporate computer-based systems for automatically handling calls and managing various operational aspects  
25   of the contact center. Contact center operations benefit from the recent availability of automated systems that deliver performance interventions, such as training content, to agents via a computer terminal.

                  Agents in contact centers and other constituent service centers must be well-trained in order to maximize their productivity and effectiveness. Agent  
30   training must be intensive and frequent in centers that handle complex interactions

with constituents or that change call scripts or other interaction programs often. In many situations, the quality and effectiveness of agent training may significantly drive the performance of the contact center.

5 In conventional contact centers, training is provided to contact center agents through a variety of mechanisms. The supervisor of the contact center may simply walk over to individual agents, place telephone calls to the individual agents, or pass on new information to the agents personally. New information may be distributed by email, by an instructor in a classroom setting, or over an intranet. Alternatively, the information may be broadcast over a public  
10 announcement system or may be displayed on a large wall display at the front of the contact center. New information may also be provided through a "chair drop" by which written information updates or training materials are handed to the agents for their consumption.

More recently, automated methods for agent training and  
15 information updating have been developed. Computer-based training ("CBT") involves the distribution of training programs to an agent's computer desktop. CBT content may be distributed in a broadcast mode, with each agent receiving the same training at the same time. CBT may more effectively be deployed by allowing individual agents to access desktop training on their own schedule and at  
20 their own pace through self-directed CBT. In self-directed CBT, each agent takes the initiative to enter a training session, and the pace and content of the training can reflect individual agent learning rates and base knowledge.

While computer-based training methods offer significant benefit in training effectiveness, efficiency, and sophistication to contact centers and other  
25 constituent contact centers, conventional CBT-based training regimens have significant drawbacks. Broadcast CBT systems generally require that a group of agents be diverted en masse from their customer interaction duties for a period of time, and those systems do not accommodate large variations in learning rate or base knowledge among agents. While self-directed CBT enables agents to learn  
30 at their own pace and to enter training sessions when they wish, conventional self-

directed training is not generally amenable to centralized management and control by the contact center. Furthermore, self-directed CBT generally does not support a coordinated approach to training or facilitate controlling the number of training sessions conducted in an increment of time. Without such coordination and control of training rate, the contact center's short-term operational effectiveness can be adversely impacted by training. Because of the limitations of conventional CBT and other performance interventions, conventional contact centers may forego providing agents with performance interventions in order to meet short-term performance objectives. Conversely, such contact centers may compromise short-term performance in order to meet long-term training objectives.

In addition to failing to balance short- and long-term objectives, conventional contact centers do not generally deliver performance interventions in a manner that adequately responds to changing conditions, such as fluctuating call volume and contact center performance. More specifically, conventional contact centers generally neither set the number of performance interventions delivered in an increment of time nor select performance interventions for delivery on the basis of such dynamic conditions.

Rather than respond dynamically to changing conditions in the contact center, contact centers often rely on conventional schedules to dictate a timeframe for delivering performance interventions. A member of the contact center's management staff usually drafts such schedules manually. Often drafted weeks in advance, the schedules are typically fixed and can not easily accommodate the inherent uncertainty and fluid nature of the contact center's operations. Consequently, such static schedules are limited in terms of capability to adjust the number of interventions delivered in an increment of time in response to the dynamic conditions of a contact center.

Another problem with conventional approaches to scheduling performance interventions in a contact center is related to the management staff's approach to generating agent work schedules. Management typically generates work schedules for the contact center's agent staff weeks in advance. Generally,

management devises these schedules with the goal of maximizing the time that each agent spends servicing contacts. Management typically prefers a schedule that keeps the agents too busy rather than a schedule that provides excess idle time. This approach not only serves short-term profit objectives, but also  
5 compensates for unanticipated lulls in the contact center's activity levels. Consequently, conventional agent schedules usually provide insufficient time for conducting performance interventions. In other words, from a planning perspective, the contact center typically does not have sufficient available time on the schedule to provide a desirable level of performance interventions.

10 Although conventional schedules do not usually accommodate an adequate level of performance interventions, the actual operations in a contact center frequently deviate substantially from the planned activities. In an ordinary day, unexpected circumstances and/or randomness cause decreases in call volume which offer an opportunity to deliver one or more performance interventions.

15 However, conventional scheduling methodologies generally do not provide for utilizing such unexpected available time. In other words, a contact center typically has incremental downtime that is underutilized for delivering performance interventions because conventional schedules typically lack provisions for its utilization.

20 What is needed is a capability for managing the number of performance interventions delivered in a contact center in an increment of time in a manner that is responsive to changing conditions in the contact center. This capability should adjust the rate of performance intervention delivery according to activity levels and performance of the contact center. Such a capability would  
25 promote the overall performance and proficiency of the agent population in the contact center without compromising the performance of the contact center during performance intervention delivery.

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## SUMMARY OF THE INVENTION

The present invention supports managing performance intervention delivery to agents in a contact center. A performance intervention can be a communication delivered to an agent with the intent to enhance the performance, proficiency, and/or effectiveness of that agent. Computer-based training can be an example of a performance intervention. A contact center can be a system staffed with agents who service customers or constituents through a communication network. An inbound call center can be one example of a contact center.

According to one aspect, the present invention can manage performance intervention delivery by controlling the rate of delivering performance interventions to agents in a contact center. Delivery rate can be the number of performance interventions for which delivery is initiated or completed in an increment of time, such as a day, an hour, or a second. Factors that describe or effect a contact center's operations can be characterized as contact center state. The rate at which the contact center services contacts or receives incoming calls are two examples of contact center state. Contact center state can also be a measurement of the center's performance, such as the average time that a contact waits prior to receiving service from an agent. The present invention can control the rate of delivering performance interventions based on a current or a forecasted state of the contact center.

According to another aspect of the present invention, management input, such as an input level of contact center state, can be a factor in managing performance intervention delivery. A computer program can compute an intervention delivery rate based on the management-input state level and a current or a predicted contact center state. The computer program can adjust the rate of delivering performance interventions to maintain contact center performance at or above a management-input performance level. Contact center performance dipping below the level can trigger a decrease in the performance intervention delivery rate. Similarly, performance rising above the level can trigger an increase in intervention delivery rate.

According to another aspect of the present invention, a computer program can select agents to receive performance interventions in conjunction with determining a rate for delivering performance interventions. Agent selection can be based on need. Lower performing agents can preferentially receive performance interventions over higher performing agents. Ranking the relative performance of each agent in a group of agents can define a sequence for delivering performance interventions to the group.

The discussion of managing performance intervention delivery presented in this summary is for illustrative purposes only. Various aspects of the present invention may be more clearly understood and appreciated from a review of the following detailed description of the disclosed embodiments and by reference to the drawings and claims.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a block diagram illustrating a system for managing a computer-based customer call center system in accordance with an exemplary embodiment of the present invention.

Figure 2 is a block diagram illustrating a system for the scheduling and delivery of training materials in accordance with an exemplary embodiment of the present invention.

Figures 3A, 3B, and 3C are flow charts indicating the steps in the methods for training a contact agent to perform constituent contact duties in accordance with an exemplary embodiment of the present invention.

Figure 4 illustrates a functional block diagram of a contact center with an Intervention Manager according to one exemplary embodiment of the present invention.

Figure 5A illustrates inputs and outputs of an Intervention Manager according to one exemplary embodiment of the present invention.

Figure 5B illustrates functional relationships between primary inputs and primary outputs of an Intervention Manager according to one exemplary embodiment of the present invention.

5 Figure 5C illustrates functional relationships between primary inputs and primary outputs of an Intervention Manager according to one exemplary embodiment of the present invention in which the rate of intervention delivery is based on intervention parameters and contact center state.

10 Figures 6A and 6B graphically illustrate adjusting the number of performance interventions delivered over time based on the state of a contact center according to one exemplary embodiment of the present invention.

Figures 7A and 7B graphically illustrate predicting the state of a contact center and managing performance intervention delivery based on the prediction according to one exemplary embodiment of the present invention.

15 Figure 8 graphically illustrates adjusting the rate of delivering performance interventions based on the state of the contact center according to one exemplary embodiment of the present invention.

Figure 9 graphically illustrates selecting performance interventions based on performance intervention priority and contact center state according to one exemplary embodiment of the present invention.

20 Figure 10 illustrates a flow chart for an algorithm for managing performance intervention delivery according to one exemplary embodiment of the present invention.

25 Figure 11 illustrates a flow chart for an algorithm for adjusting the rate of delivering performance interventions according to one exemplary embodiment of the present invention.

Figure 12 illustrates a flow chart for an algorithm for selecting performance interventions according to one exemplary embodiment of the present invention.

Figure 13 illustrates a flow chart for an algorithm for selecting agents to receive performance interventions according to one exemplary embodiment of the present invention.

5 Figure 14 illustrates a flow chart for an algorithm for delivering performance interventions to agents according to one exemplary embodiment of the present invention.

Figure 15 illustrates a flow chart for an algorithm for controlling the delivery of performance interventions to agents according to one exemplary embodiment of the present invention.

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#### **DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS**

The present invention is directed to managing the delivery of performance interventions, such as training sessions, to agents in a contact center to enhance the operational effectiveness of the contact center. Delivering  
15 performance interventions increases the effectiveness, performance, and proficiency of the agent population. Managing the delivery of performance interventions to agents includes controlling the intervention delivery process to avoid adversely impacting the performance of the contact center during intervention delivery.

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Description, Figures 1-3

Turning now to the drawings, in which like numerals indicate like elements throughout the several figures, an exemplary embodiment of the invention will now be described. Figures 1-3 are directed to the scheduled  
25 delivery of content, such as training, to a constituent contact agent, such as a call center agent. Although Figures 1-3 will be described with respect to the delivery of training materials to an agent in a call center, those skilled in the art will recognize that the invention may be utilized in connection with the scheduled delivery of a variety of information in other operating environments.



FIG. 1 illustrates a computer system for managing a call center in which one advantageous embodiment of the present invention is implemented. The illustrated call center **10** includes a training system **20** operative to schedule and deliver training materials to call center agents **40**. In a typical application of the call center **10**, a customer **30** calls via the public switched telephone network ("PSTN") or other network to the call center **10**. The customer call may be initiated in order to sign up for long distance service, inquire about a credit card bill, or purchase a catalog item, for example. Through the PSTN **34**, the call from the customer **30** reaches an Automatic Call Distribution ("ACD") component **32** of the call center. The ACD component functions to distribute calls from customers to each of a number of call center agents **40** who have been assigned to answer customer calls, take orders from customers, or perform other duties. Agents are typically equipped with a phone **42** and a call center computer terminal **44** for accessing product information, customer information, or other information through a database. For example, in a call center implemented to support a clothing catalog, the terminal **44** for an agent could display information regarding a specific item of clothing when a customer **30** expresses an interest in purchasing that item.

Customer phone calls and relevant database information are integrally managed by modern call centers **10** through what is known as computer/telephone integration ("CTI"). A CTI component **34** enables the call center **10** to extract information from the phone call itself and to integrate that information with database information. For example, the calling phone number of a customer **30** may be used in order to extract information regarding that customer stored in the call center database and to deliver that customer information to an agent **40** for the agent's use in interacting with the customer. CTI **34** may also interact with Intelligent Voice Response ("IVR") unit **36**, for example to provide a touchtone menu of options to a caller for directing the call to an appropriate agent.

Depending on the nature and function of the call center, a constituent contact engine **38** is a software-based engine within the call center **10**

that manages the interaction between customers and agents. For example, the constituent contact engine 38 may sequence the agent 40 through a series of information screens in response to the agent's information input during a customer call. The agent advantageously provides input to the constituent contact engine 38  
5 through an agent user interface 46, which is typically a graphical user interface presented at a computer terminal 44.

A typical call center 10 includes a Workforce Management ("WFM") component 48. WFM component 48 is used to manage the staffing of agents 40 in the call center 10 so that call center productivity can be optimized.  
10 For example, the volume of calls into or out of a call center 10 may vary significantly during the day, during the week, or during the month. WFM component 48 preferably receives historical call volume data from ACD component 32. The WFM component 48 can determine an appropriate level of staffing of agents 40 so that call hold times are minimized, on the one hand, and  
15 so that agent overstaffing is avoided, on the other hand.

In a typical call center, customer calls and interactions between customers and agents 40 are selectively sampled as part of a quality control program within the call center 10. This function is typically performed through a Quality Monitoring component 50 that monitors voice interaction through the  
20 agent's phone 42 and monitors information delivered through the system to the agent's terminal 44. In addition, Customer Relationship Management ("CRM") systems 52 are often employed in call centers for a variety of marketing or customer service functions. For example, a CRM system 52 may be used to suggest to a caller ordering a certain book that the caller may wish to purchase  
25 other related books or other books that have been ordered by purchasers of the same book.

The call center 10 includes a communications network 54 to interconnect and link the aforementioned components. For a call center in which all elements are located at the same site, for instance, a local area network may  
30 provide the backbone for the call center communications network 54. In call

centers for which the elements are geographically dispersed, the communications network may comprise a wide area network, a virtual private network, a satellite communications network, or other communications network elements as are known in the art.

5                   The training system 20 according to one advantageous embodiment of the present invention is implemented in software and is installed in or associated with the call center computer system 10. By integration with the WFM component 48 and/or the CTI 34 of the call center, the training system 20 can deliver training material to agents 40 via communications network 54 in  
10                   scheduled batches. Integration with the WFM component 48 and the CTI 34 enables the training system 20 to deliver training materials to agents at times when those agents are available and when training will not adversely impact call center performance. The training system 20 is also preferably in communication with quality monitoring component 50 through the communications network 54 so that  
15                   training materials may be delivered to those agents who are most in need of training. Proficient agents are thus spared the distraction of unneeded training, and training can be concentrated on those agents most in need. Advantageously, call center management may set pass/fail criteria within the quality monitoring component 50 to trigger the scheduling of appropriate training to appropriate  
20                   agents. This functionality may be provided via a rules engine implemented as part of the training system 20 or within the contact engine of the call center. By integrating with the CTI 34, the training system 20 can deliver training materials based on CTI-derived data such as customer call volume, independent of or complemented by the training schedule derived from the workforce management  
25                   component 48 or the work distribution component 32.

                  In another advantageous embodiment of the present invention, the training system 20 may be deployed on a stand-alone server located remotely from call center 10. For example, training system could be deployed to serve a number of independent call centers 10, such as in a “web services” business model. In  
30                   such a remote deployment, the problems of integration with individual call center

computer systems can be avoided and the training system **20** can be maintained at a single central location.

A wide range of agent training scenarios can be supported by the training system **20**. The training materials that are appropriate for a particular call center application can vary according to the call center function. The subject matter of training materials may also vary widely; for example, training materials may be focused on product information, phone etiquette, problem resolution, or other subjects.

**FIG. 2** is a block diagram illustrating a training system **20** for the scheduling and delivery of training materials to call center agents **40** in a call center **10**. The training system includes a number of interoperable software modules. Training authoring tool **100** is a software module that enables the managers of a call center to develop training materials, training courses, training quizzes, and other information to be delivered to agent **40** in the call center. Training system **20** preferably further includes a training management tool **102** that enables call center managers to assign agents to groups for training purposes, to assign training materials to individual groups, and to assign groups of courses to supersets of training groups.

The training system **20** preferably further includes an information delivery tool **104** that determines when the training materials assigned by the training management tool **102** are to be delivered to agents. The information delivery tool **104** preferably receives agent workload data and call center load data from ACD **32** through CTI **34**. The information delivery tool **104** also preferably receives agent schedule data from WFM **48**. The training system further comprises information access tool **106** for delivering the training materials to agents over communications network **54** on a scheduled basis so as not to disrupt agent customer contact duties. Agent consumption of training and training quiz performance are tracked by the reporting module **108**, which is preferably adapted to generate standard and custom reports to enable call center managers and supervisors to more effectively manage agent performance and training.

Turning now to FIGS. 1, 2, and 3A, the steps in a method for delivering scheduled training to a contact agent within a call center operating environment are illustrated in flow chart form. The method begins at step 200. At step 202, the information delivery tool 104 within training system 20 accepts agent schedule data from WFM component 48 of the call center computer system 10. The agent schedule data may be in many forms, but in one example the data includes agent assignments to the call center sorted by quarter-hour over a period of several days. At step 204, the training system 20 analyzes the agent schedule data provided by the WFM component 48 to determine whether the agent is scheduled for training. The method then proceeds to step 206; if the agent is not scheduled for training, the “No” branch of the flow chart is followed and the method returns. If the agent is scheduled for training, then the “Yes” branch is followed to step 208, where the agent’s interaction with the agent user interface is monitored by information delivery tool 104 of the training system 20. For example, mouse movements or keyboard activity at the agent user interface can be monitored to determine whether the agent is handling a customer call. The method then proceeds to step 210, where the training system 20 determines, from the user interface activity, whether or not the agent is available for training. If the agent is not available for training, the method proceeds through the “No” branch to a wait loop at step 211 and the agent’s interaction with the agent user interface is again monitored at step 208. If the agent is available for training, the method proceeds through the “Yes” branch to step 212, at which step the agent is prompted by the training system that training is available. This prompt may, for example, take the form of a pop-up screen delivered to the agent’s terminal displaying a message indicating that training is now available for the agent.

The method then proceeds to step 214 at which step the training system 20 looks for an acknowledgment from the agent that the agent is ready for training. If the agent has not acknowledged by a certain predetermined time, for example, then the method proceeds through the “No” branch and returns. If the agent does acknowledge that the agent is ready for training, the method proceeds

through the “Yes” branch to step **218**, at which step training materials are delivered to the agent by information access tool **106** within the training system **20** over the communications network **54**. Preferably, the agent has logged off of the call center computer system contact engine **38** before the training materials are delivered. In this exemplary method, the training materials delivered can, for example, comprise a sequenced series of training segments each of limited duration that together form an integrated whole. Of course, the training materials can vary considerably from call center to call center as dictated by the function of the call center and the business supported by the call center **10**. The training materials delivery step **218** may be set to terminate after a predetermined amount of time. The method then terminates at step **220**.

Accordingly, the method according to one exemplary embodiment as illustrated in the flow diagram of FIG. **3A** accepts and analyzes agent schedule data provided from the WFM component of a call center computer system in order to non-disruptively schedule and deliver agent training.

According to another advantageous embodiment, the steps in a method for managing a call center or other constituent contact system are illustrated in the flow diagram of FIG. **3B**. According to this exemplary method, information from both the workforce management component **48** and the automatic call distribution component **32** are used by information delivery tool **104** within the training system **20** to non-disruptively schedule and deliver agent training. Referring now to FIGS. **1**, **2**, and **3B**, the method begins at step **240**. At step **242**, the information delivery tool **104** accepts agent schedule data from a workforce management component **48** of the call center computer system **10**. The method then proceeds to step **244**, where the agent schedule data is analyzed by the training system, and then proceeds to step **246**. If the training system **20** determines at step **246** that the agent is not scheduled for training, based on the analysis of the agent’s schedule data, then the method proceeds through the “No” branch and returns. If the training system **20** determines at step **246** that the agent

is scheduled for training, then the method proceeds through the “Yes” branch to step 248.

The information delivery tool 104 of the training system 20 accepts agent workload data at step 248 from the automatic call distribution component 32 or other work distribution component of the call center system. Moving to step 250, the training system 20 analyzes the agent workload data to determine whether the call center’s workload metrics (such as call volume or hold time) exceed certain predetermined thresholds. If the call center or the individual agent are too busy for the agent to be available for training, the method proceeds through the “No” branch at step 252 and returns. If the analysis of the call center metrics indicates that the agent is available for training, the method proceeds through the “Yes” branch to step 254.

At step 254, the training system 20 monitors the agent’s interaction with the agent user interface, such as by monitoring mouse movements or terminal keystrokes. The training system 20 thereby determines whether or not the agent is available for training at step 256. If unavailable, the method proceeds through the “No” branch to wait loop at step 258, and the agent’s interaction with the agent user interface is again monitored at step 254. If the agent is available for training, the method proceeds through the “Yes” branch to step 260.

At step 260, the agent 40 is prompted by the training system 20 that training is available. The prompt to the agent may, for example, be in the form of a pop-up screen delivered to the agent’s terminal 44 informing the agent that training is available. According to the method, the training system then waits for an acknowledgment by the agent that the agent is ready for training, as shown at step 262. If the agent does not acknowledge that it is available for training, the method proceeds through the “No” branch and returns. If and when the agent acknowledges the prompt, the method proceeds through the “Yes” branch to step 264 and the agent is disconnected from the contact engine 38 within the call center computer system 10 so that interference between the training session and customer calls can be avoided. At step 266, the information access tool 106 of

training system 20 delivers training materials to the agent 40 over the communications network 54.

The information delivery tool 104 monitors the work distribution component 32 at step 267 and determines whether predetermined agent or call center workload thresholds are exceeded during training material delivery. If agent or call center thresholds are not exceeded, then training material delivery continues at step 266. If thresholds are exceeded at step 267, the agent is reconnected to call center contact engine 38 at step 268 to resume customer contact duties, and the method then terminates at step 270.

The agent workload data provided by the ACD 32 or other work distribution component in the method illustrated in FIG. 3B may take many forms. For example, the agent workload data may simply indicate that the level of call center activity within the system exceeds a certain predetermined threshold, and that no training for any agent is therefore appropriate at that time. As another example, the agent workload data may include individual workload data for each of several agents, indicating which, if any, agents are available for a training session. In any event, the agent workload data is preferably real-time or near real-time data reflecting the activity within the call center.

Workload thresholds for all agents as a group or for individual agents may be set advantageously by the manager of the call center depending on the needs of the particular call center. For example, if reports from the quality monitoring component 50 indicate that the quality of call center interactions with customers has declined over the past week, the thresholds may be adjusted so that training is provided even when the call center is relatively busy. Advantageously, these thresholds may also be set automatically as a function of data supplied by the quality monitoring component 50.

FIG. 3C illustrates the steps in a method according to another advantageous embodiment of the present invention. As shown in FIG. 3C, a method is provided for managing a constituent contact system for a call center based on workload data from a work distribution component, such as an ACD.



Referring now to FIGS. 1, 2, 3C, the method starts at step 280. At step 282, the information delivery tool 104 of the training system accepts agent workload data from the ACD 32 or other work distribution component. At step 284, the training system 20 builds a workload data history from the agent workload data supplied by the ACD 32. The workload data history may comprise, for example, data indicating the activity for all agents as a whole or for individual agents as a function of recent time. This data is advantageously used by the training system to forecast when and if all agents or some agents should be available for training at some point in the future. For example, if the workload data history indicates that call volume drops significantly between 10 p.m. and midnight on Fridays, then the training system can, by leveraging data from other systems, forecast that call volume will drop next Friday evening. The training system 20 can thereby determine if an agent should be available for training at some point in the future, such as next Friday evening, based on the workload data history.

If the training system 20 determines at step 286 that the agent should be available at an upcoming time, the method proceeds through the “Yes” branch to step 287. If the system forecasts at step 286 that the agent will not be available at the upcoming time, the method proceeds through the “No” branch and returns. At step 287, the training system monitors predetermined agent and call center workload thresholds. If those thresholds are not exceeded, the system proceeds to step 288. If those workload thresholds are exceeded, the system returns to step 284 and updates the workload data history.

At step 288, the training system 20 monitors the interaction of the agent 40 with the agent’s user interface 46, such as mouse movements or keystrokes. If the training system 20 determines at step 290 that the agent is not interacting with the agent’s user interface 46, then the method proceeds through the “Yes” branch to step 294. If the agent is interacting with the agent’s user interface, then the method proceeds through the “No” branch from step 290 to the wait loop at step 292 and again monitors agent user interface activity at step 288.

At step 294, the system prompts the agent that training is available. If the agent does not acknowledge the prompt at step 296, the method returns. If the agent acknowledges the prompt at step 296, the system disconnects the agent from the call center contact engine at step 298 and proceeds to step 300.

5                   At step 300, training materials are delivered by the information access tool 106 to the agent 40 over the communications network 54. Workload metrics for the agents in the call center and for the call center as a whole are monitored according to step 302; if the workloads exceed predetermined thresholds, then the method proceeds through the "No" branch back to step 300  
10 and the delivery of training materials continues. If, on the other hand, the workload levels through the training system increase beyond a predetermined threshold or a predetermined length for the training session is exceeded during the delivery of training materials to the agent, then the method proceeds through the "Yes" branch to step 304, and the agent is reconnected to the call center contact  
15 engine so that the agent can return to handling customer call. The method ends at step 306.

                  It should be emphasized that the illustration of a call center environment in the preceding discussion is an example of one common application that can take advantage of the present invention, but that the present  
20 invention is not limited to call centers or to the delivery of training materials. The methods provided by the present invention can be applied in any constituent contact environment and may include a variety of media through which contact with constituents may be made by the constituent contact system. For example, constituents may include, in addition to customers, the employees of an  
25 organization, sale representatives of an organization, suppliers of an organization, contractors of an organization, or other constituents.

                  Moreover, according to the present invention, the medium of communication between the system and the constituents may include voice contact over the public switched telephone network, e-mail communications  
30 provided through the Internet, Internet-based "chat" contact, video

communications provided over the Internet or over private broadband networks, or other communications media and forms as are known in the art.

In addition, the method provided by the present invention includes the delivery of a broad range of information to constituent contact agents. In  
5 addition to the training materials described above by way of example, any sort of information amenable to distribution via a digital communications network may be delivered in accordance with present invention. For example, new information, real-time video, sporting event information, music, conference call voice and video information, or other text, audio, video, graphics, or other information may  
10 be delivered without departing from the invention.

According to another aspect of the invention, a computer readable medium having computer executable instructions is provided that includes software components adapted to perform steps corresponding to the steps in the methods described above. According to one advantageous embodiment, a  
15 scheduling component, a monitoring component and a delivery component are provided. The scheduling component accepts agent schedule data from the training system or the other constituent contact system, including data regarding the assignment of an agent within the organization to perform communications duties via the system. The scheduling component also analyzes the agent  
20 schedule data to determine when the agent is scheduled to receive information and to schedule an information delivery session for the agent. The monitoring component monitors the agent's communications with constituents, such as through monitoring a user interface, in order to determine whether or not the agent is available to receive the information. The delivery component is adapted to  
25 deliver information to the agent over the communications network at times when the agent is scheduled to receive information as well as available to receive information.

In summary, the present invention can schedule and deliver training or other information to agents in a call center or other constituent contact  
30 system. Training materials or other information may be scheduled and delivered

to an agent without disrupting the agent's customer contact duties. Agent schedule data from a workforce management component or agent workload data from a work distribution component may be analyzed to decide whether or not an agent is scheduled for training or available for training. The user interface on the agent's terminal may be monitored by the training system 20 to determine whether the agent is busy interacting with constituents. If the agent is not busy, training materials or other information may be delivered to the agent's desktop through the system's communications network. To avoid interference between a training session and the agent's customer call duties, the agent may be disconnected from the system's customer contact engine before delivery of the training materials. If the call center's call volume or other metric exceeds a predetermined threshold during the training session, the session may be discontinued so that the agent may return to the agent's customer call duties.

15 Description, Figures 4-15

In addition to those embodiments discussed in connection with Figures 1-3, further embodiments of the present invention will be described in reference to Figures 4-15.

A performance intervention is a communication delivered, preferably via computer, to an agent with the intent to enhance the performance, proficiency, and/or effectiveness of that agent. A computer system can deliver the communication automatically or in response to manual input. The communication may be delivered exclusively via computer; alternatively, a computer and a human can collaborate to deliver the communication. For example, the computer can print out a recommended coaching script, and a human can follow the script in delivering coaching via traditional verbal communication. CBT sessions are one example of performance interventions. Reprimands, rewards, advice, coaching, one-on-one coaching, peer-to-peer coaching, supervisor-to-peer coaching, notices, warnings, feedback, reports, compliance statistics, performance statistics, and acknowledgements are other examples of performance interventions.

The term “state” or “contact center state” is used herein to refer to factors that describe or effect the contact center’s overall operations. Contact center state includes measurements related to workload or activity level such as current call volume, historical call volume, and forecast call volume, each of which is sometimes described seasonally or over another increment of time. Contact center state also includes performance of the contact center. Time metrics of a contact center’s performance include average handling time, hold time, average waiting time for each incoming call, and the fraction of calls connected to an agent within a specific length of time following call receipt. Additional metrics of contact center performance include agent performance indicators aggregated to the entire center and/or the center’s agent population. Customer satisfaction index, abandonment, service level, compliance statistics, revenue goals and actuals, service level, new product roll out schedules, management directives, natural disasters, and catastrophic events are further examples of contact center state.

The term “abandonment rate” refers to the fraction of contacts who are engaged with the contact center but disconnect communication with the contact center prior to receiving service from an agent. The term “call volume” or “contact volume” refers to the number of calls or contacts that are engaged with the contact center in a unit of time, such as per day, per hour, per minute, or per second. The term “hold time” refers to the length of time between the contact center engaging a contact and an agent of the contact center initiating service with the contact. For example, hold time in an inbound call center is the time that the caller must wait on hold prior to being connected to an agent. The term “service level” refers to the percentage of incoming inquiries that are addressed in a target period of time, such as 80% of incoming calls answered within ten seconds.

The term “state level” or “state level setting” is used herein to refer to a specified contact center state. For example, management can define a state level specifying that at least 80% of calls should be answered within twenty seconds and that a lower percentage of calls answered is unacceptable. A state

level can also be a target or otherwise desired operational state. A “performance level” or a “performance level setting” is a state level setting for a performance-based state. “State range” is a range of states. Two examples of state ranges are the states that are above a specified state level and that states that are between an upper state level and a lower state level.

The term “contact center” is used herein to include centers, such as service centers, sales centers, and call centers that service inbound calls and/or outbound calls. A contact center can serve customers or constituents that are either internal or external to an organization, and the service can include audible communication, chat, and/or e-mail. A contact center can be physically located at one geographic site, such as a common building or complex. Alternatively, a contact center can be geographically dispersed and include multiple sites with agents working from home or in other telecommuting arrangements.

A typical computer-based contact center is an information rich environment. A network of data links facilitates information flow between the center’s component systems. By tapping this network, the present invention can access historical, current, and forecast information from various center components and utilize this information in the process for managing performance intervention delivery. Consequently, the present invention can be responsive to new situations in the contact center environment, to fluctuations in contact center activity, and to other changes in the center’s state.

Although an embodiment of the invention will be described with respect to managing the delivery of performance interventions at a contact center, those skilled in the art will recognize that the invention may be utilized in connection with the deployment of a variety of resources in other operating environments. One example other than a traditional call center environment is a technical support center within an organization that serves employees or members. Those skilled in the art will further recognize that the present invention may be utilized in connection with servicing inbound and outbound contacts at a contact center.

More generally, the business function provided by a contact center may be extended to other communications media and to contact with constituents of an organization other than customers. For example, an e-mail help desk may be employed by an organization to provide technical support to its employees. Web-based “chat”-type systems may be employed to provide information to sales prospects. When a broadband communications infrastructure is more widely deployed, systems for the delivery of broadband information, such as video information, to a broad range of constituents through constituent contact centers will likely be employed by many organizations.

Turning now to discuss each of the drawings presented in Figures 4-15, in which like numerals indicate like elements throughout the several figures, an exemplary embodiment of the invention will be described in detail.

Figure 4 illustrates a system for managing a contact center in which one advantageous embodiment of the present invention is implemented. A contact center **400** includes an arrangement of computer-based components coupled to one another through a set of data links **54** such as a network **54**. While some contact center functions are implemented in a single center component, other functions are dispersed among components. The information structure of the contact center **400** offers a distributed computing environment. In this environment, the code that supports software-based process steps does not necessarily execute in a singular component; rather, the code can execute in multiple components of the contact center **400**.

The communication network **54** of the contact center **400** facilitates information flow between the center’s components. For a contact center **400** in which all elements are located at the same site, a local area network (“LAN”) may provide the backbone for the contact center communication network **54**. In contact centers **400** with geographically dispersed components, the communications network **54** may comprise a wide area network (“WAN”), a virtual network, a satellite communications network, or other communications network elements as are known in the art.

In a typical application of the contact center **400**, a customer or other constituent calls the contact center **400** via the public switched telephone network (not illustrated in Figure 4) or other communication network. The customer may initiate the call in order to sign up for long distance service, inquire  
5 about a credit card bill, or purchase a catalog item, for example.

An automatic call/work distribution (“ACD”) component **32** receives incoming calls from the telephone network, holds calls in queues, and distributes these calls within the contact center **400**. ACD software generally executes in a switching system, such as a private branch exchange. The private  
10 branch exchange connects customer calls to terminals **44** operated by contact center agents **40** who have been assigned to serve one or more specific queues, for example to answer customer complaints, take orders from customers, or perform other interaction duties. In alternative embodiments of the invention, the function of the ACD **32** can be replaced by other communications routers. For example, in  
15 a contact system **400** using email, an email server and router can distribute electronic messages.

The ACD **32** maintains one or more queues for holding each incoming call that is waiting to be routed to an agent **40**, who will service the call. Upon receipt of an incoming call from a customer or other constituent, the ACD  
20 **32** categorizes the call and identifies, on the basis of the categorization, a specific queue to hold the call. The ACD **32** then places the call in the specific queue and selects one agent **40** to service the call from a group of agents assigned to service the specific queue. By activating a physical switch, the ACD **32** then routes the call to the select agent **40**.

The ACD **32** uses a rules-based distribution engine **425** to categorize each incoming call by applying categorization rules to information that is known about the call. Based on the categorization, the ACD **32** matches the call with one of several queues. In other words, each queue holds a specific category of call. For example, one queue might hold calls from Spanish-speaking  
25 callers seeking to order flowers while another queue might hold calls from  
30



English-speaking callers seeking to order candy. The rules based distribution engine 425 includes software algorithms that select a specific agent 40 to receive the incoming call. The software algorithms match the call to an agent 40 who is available and has appropriate qualifications and performance history.

5                   When the ACD 32 routes the call to an available agent 40, the agent 40 receives the call and communicates with the caller over a telephone 42 while entering and receiving information through a computer terminal 44. The terminal 44 provides the agent 40 with access to product information, customer information, or other information through databases. For example, in a contact center 400 implemented to support a catalog-based clothing merchant, the  
10                   computer terminal 44 for an agent 40 could display information regarding a specific item of clothing when a customer expresses an interest in purchasing that item. Agents 40 can also view information about the call that the ACD 32 derived from the call when the call first came into the contact center 400. A desktop  
15                   application, which is usually a customer resource management component (not shown in Figure 4), facilitates an agent's interaction with a caller.

                  In addition to routing calls, the ACD 32 monitors and records call volume and call processing statistics, which are forms of contact center state 432. Thus, the ACD 32 is one type of monitor in the contact center 400 that provides  
20                   contact center state 432. The ACD 32 provides current and historical measurements 432 of the number of calls that the contact center 400 receives for an increment of time, such as the number of calls received per second, per day, or per shift. The ACD 32 records the length of time 432 that each call waits in a queue before being serviced by an agent 40 and the length of each call. Upon  
25                   query, the ACD 32 provides aggregate wait time statistics 432 for a specified period of time. The ACD also tracks after-call work, such as notes that an agent enters into the system after concluding service with a contact.

                  To support routing calls to agents 40 who are available to receive calls, the ACD 32 maintains an activity code for each agent 40. Each agent's  
30                   activity code describes that agent's current activity. For example, an activity code

may report that an agent 40 is servicing a call, idle and waiting to be connected to an incoming call, receiving a performance intervention, taking a break, or in after-call work.

5 In addition to describing the availability to receive an incoming call, the ACD's activity codes support determining each agent's availability to undertake specific activities. Thus, the ACD 32 maintains data 435 that describes each agent's availability to receive performance interventions. This data 435 is available via the contact center's network 54 to various systems in the center 400, including a workforce management ("WFM") component 48.

10 The WFM component 48 manages the staffing level of agents 40 in the contact center 400 to support improving the contact center's productivity and profit. For example, the volume of calls into or out of a contact center 400 may vary significantly during the day, during the week, or during the month. The WFM component 48 can receive historical call volume data from the ACD 32 and  
15 use this information to create work schedules 440 for agents 40. WFM components 48 commonly employ the Erlanger Algorithm, which is known to those skilled in the art, to forecast scheduling resources. Historical call volume data 432 can be the basis for forecasting future call volume 432 and/or other forecasts of the contact center's state 432. The WFM component 48 can generate  
20 current and forecasted state 432 based on data from the ACD 32 and from its internal information regarding agent staffing.

In one embodiment of the present invention, the WFM component 48 receives current and historical call volume data 432 from the ACD 32. The WFM component 48 fits current and recent call volume data 432 to historical data  
25 patterns and projects this data 432 into the future to derive a forecasted call volume 432. In one embodiment of the present invention, this projection is based on a simple linear curve fit. The WFM component 48 overlays forecasted call volume 432 onto an agent work schedule 440 to provide a forecast of contact center performance 432.

The WFM component 48 also communicates time and attendance data 441 to the contact center's human resources and payroll system 442. This communication facilitates computing an agent's compensation based on that agent's activities. Agents 40 may receive bonuses upon complying with a goal, such as servicing calls for more than a specified percentage of the time in a shift. To avoid penalizing an agent 40 for time spent receiving a performance intervention, the WFM component 48 sends a record 441 of such time to the center's human resources and payroll systems 442. The human resources and payroll systems use this information 441 to compute the agent's compensation. In other words, the WFM component 48 communicates information 441 to the human resources and payroll system 442 to facilitate rewarding an agent 40 for productive activities and to avoid penalizing an agent 40 for mandated activities.

Also, an agent 40 in a contact center 400 may receive a bonus or variable pay based on how well the agent 40 adheres to a schedule. To avoid considering an agent 40 out of compliance during the delivery of a performance intervention, the WFM component 48 is notified of the intervention delivery.

As yet another example of coordinating and tracking activities in the contact center 400, the intervention delivery system 430 periodically synchronizes with the WFM component 48 and the ACD 32. The synchronization process includes synchronizing for time spent in training and compliance with training schedules. In one embodiment of the present invention, the Intervention Manager 460 executes this synchronization process.

An agent performance evaluator 410 provides measurements and indications of agent performance that are useful to management and to the various components of the contact center 400. The agent performance evaluator 410 stores these measurements and indications in the agent profiles database 449 and regularly updates them. That is, an agent profile, which is stored in the agent profiles database 449 can include one or more indications of an agent's performance. Various components of the contact center 400 can access this data though the contact center's network infrastructure 54.

In addition to agent performance data, an agent profile can include other agent parameters that describe an agent's capability to contribute to the contact center **40**. For example, it can include a characterization of an agent's skills and competencies. Also, it can include an agent's traits, such as personality  
5 and cognitive traits.

The agent performance evaluator **410** typically determines the level of agent skill and competency in each of several areas by accessing information from the center components that collect and track agent performance information. Examples of these components include, but are not limited to, the intervention  
10 delivery system **430**, the WFM component **48**, the ACD **32**, and a quality monitoring system (not illustrated in Figure 4). The relevant skills and competencies for a contact center **400** serving a catalog clothing merchant could include product configuration knowledge (e.g. color options), knowledge of shipping and payment options, knowledge of competitor differentiation, finesse of  
15 handling irate customers, and multilingual fluency.

In one embodiment of the present invention, the agent performance evaluator **410** includes an agent performance ranking function that assigns a performance rank, or index, to each agent **40**. The agent performance evaluator **410** stores each agent's rank in the agent profiles database **449** and provides a list  
20 of agents **40** ordered by performance rank to the Intervention Manager **460**.

The agent performance evaluator **410** also stores raw monitoring data describing agent performance in the agent profiles database **449**. This database **449** is typically maintained in a bulk storage drive or the hard drive of a LAN server, where the data is readily accessible to the Intervention Manager **460**  
25 as well as other devices in the contact center **400**. Agent performance data includes raw performance statistics as well as aggregated statistics and derived metrics. The agent performance evaluator **410** also generates agent performance data based on performance-related information from various components in the contact center **400**. For example, the agent performance evaluator can compute  
30 metrics of agent performance, which are characterizations of an agent's job

performance, utilizing handling time statistics that are tracked by the ACD 32. Such statistics can be tracked by one or more of the other systems in the contact center 400, such as a customer resource management component (illustrated in Figure 1 but not in Figure 4). In one embodiment of the present invention, the  
5 agent performance evaluator 410 determines performance indicators such as: close ratio, first call resolution, quality, complaint ratio, cross-sales rate, revenue per call, and average handling time for each agent 40.

In one embodiment of the present invention, the agent performance evaluator 410 is a system that is physically dispersed in the contact center 400. In  
10 this configuration, the agent performance evaluator 410 can include the system components in the contact center that contain agent performance information such as average handling time, close ratio, quality, etc. The intervention delivery system 430 uses performance monitoring data to ascertain performance gaps that exist for one or more agents 40 so that appropriate performance interventions can  
15 be assigned to address those gaps. Analyzing one or any combination of performance metrics can determine the need for performance interventions. For example, if an agent's revenue per call is below average, then the intervention delivery system 430 could elect to deliver sales tips.

The agent profiles database 449 includes agent performance  
20 indicators for each agent 40. Performance indicators for an agent 40 are metrics of that individual agent's actual on-the-job performance. Performance indicators include quality, call handling time, first call resolution, cross-sell statistics, quality, close ratio, revenue per hour, revenue per call, calls per hour, and speed of answer, for example. Agent performance reflects an aspect of an agent's  
25 demonstrated service of a real contact.

The agent profiles database 449 also includes agent qualifications data for each agent 40. Agent qualifications are distinct from agent performance. Agent qualifications reflect characteristics of an agent 40. Although agent qualifications are sometimes correlated to on-the-job performance, agent  
30 qualifications are not necessarily correlated to performance. For example, an

agent who is highly trained on the technical aspects of diamonds may be an inept diamond seller as measured by actual, on-the-job performance. Agent qualifications include an agent's innate traits such as cognitive skills and personality. Agent qualifications also include an agent's skills and competencies.

5 Foreign language fluencies, product expertise acquired by receiving performance interventions involving specific products, and listening skills are examples of an agent's skill and competency qualifications.

The intervention delivery system 430 and the agent performance evaluator 410 update the agent profile database 449 when new information is

10 available from the various computer-based components in the contact center 400. In one embodiment of the present invention, the agent profiles database 449 preferentially includes real-time data regarding agent qualifications and performance indicators such as agent parameters data 450.

The term "agent parameters" as used herein refers to any

15 characteristic of an agent 40 that is pertinent to performance intervention delivery. Agent performance, agent qualifications, work schedules, successful completion of performance interventions, time since last intervention, and performance intervention assignment are examples of agent parameters.

An agent's ability to impact the operational effectiveness of the

20 contact center 400 is another example of an agent parameter. Agent parameters can also include an estimate or other indication of the benefit that the contact center 400 is likely to derive from delivering a performance intervention to a specific agent 40. In other words, delivering a performance intervention to an agent 40 should benefit the contact center by improving the contact center's long-

25 term operational effectiveness. An agent parameter can be a relative or absolute characterization of such improvement or benefit.

An agent 40 who is a poor performer may realize significant performance improvement from one or more performance interventions. This may be especially true for new-hire agents who have high cognitive abilities and

30 desire to excel. In contrast, a senior agent 40 who is a strong performer may gain

only modest benefit from a performance intervention, especially if the performance intervention is not geared towards advanced instruction. Thus, selecting poor performers to preferentially receive performance interventions can benefit the contact center **400** as a whole. Nevertheless, certain poor performers  
5 may achieve little or no performance gain from an extensive regime of performance interventions. In other words, the agent population **40** may include agents **40** with a low propensity to improve with training or other performance interventions. An agent parameter that describes benefit to the contact center **400** derived from delivering a performance intervention to a specific agent **40** can  
10 reflect agent trainability as well as other considerations.

“Intervention assignment” or “performance intervention assignment” refers to the interventions that are assigned to be delivered to one or more agents **40**.

The intervention delivery system **430** accepts performance  
15 monitoring input from the agent performance evaluator **410** via the agent profiles database **449** as feedback for agent performance intervention programs, such as training programs. In one embodiment of the present invention, the intervention delivery system **430** is a training system that delivers instructive content to agents **40**. In one embodiment of the present invention, the intervention delivery system  
20 **430** is a CBT system that is implemented in software and coupled to the contact center’s communications network **54**. Under the control of the Intervention Manager **460**, the intervention delivery system **430** delivers intervention content in a manner that promotes both the short- and long-term performance of the contact center **400**. Furthermore, the intervention delivery system **430** delivers  
25 content to agents **40** at times when those agents are available and when the performance intervention will not adversely impact the contact center’s operations.

The intervention delivery system **430** is also in communication  
with the agent performance evaluator **410** through the Intervention Manager **460**  
30 so that appropriate intervention content, such as training materials, may be

delivered to the agents 40 who are most in need of receiving a performance intervention. Proficient agents 40 are thus spared the distraction of unneeded performance interventions, and interventions can be concentrated on those agents 40 most in need and on areas of greatest need for those agents 40. Contact center management may establish pass/fail or remediation thresholds to enable the assignment of appropriate performance interventions to appropriate agents 40. This functionality is provided within the Intervention Manager 460. Preferably, agent skills that are found to be deficient relative to the thresholds are flagged and stored in a storage device within the agent profiles 42.

The intervention delivery system 430 can assess various aspects of an agent's qualifications. By administering a traits test, the intervention delivery system 430 characterizes an agent's personality and cognitive abilities. A traits test is typically only administered once for each agent 40, since for most agents 40, cognitive ability and personality do not change dramatically during employment. By administering a skills and competencies test, the intervention delivery system 40 can identify knowledge gaps and determine agent qualifications that improve with training and on-the-job experience.

With an understanding of agent's skills and competencies, performance interventions can be administered to improve skills and competencies. Once the performance intervention is administered, an assessment can be provided to ensure the agent 40 understood and retained the content. In addition, the agent's performance can be monitored to determine if performance has changed based upon the acquisition of the new information. When the agent's performance has changed, the intervention delivery system 430 can automatically update the agent's skills and competencies in the agent profiles database 449, thereby maintaining an up-to-date view of agent qualifications. Similarly, the intervention delivery system 430 maintains an intervention profiles database 469 that holds intervention parameters 470 and other descriptive information regarding each performance intervention in the contact center's portfolio of performance interventions.



The term “intervention parameter” as used herein refers to any attribute of an intervention that is pertinent to intervention delivery. Examples of intervention parameters include length of intervention, priority of intervention, and requirement to deliver the intervention by a deadline.

5                   In tandem with the agent performance evaluator **410**, the intervention delivery system **430** can determine if an agent **40** effectively practices the subject matter of a completed performance intervention, such as a training session. Immediately following a computer-administered test, the results are available throughout the contact center’s information network infrastructure **54**.

10                   Coupled to the information infrastructure **54** of the contact center **400**, the Intervention Manager **460** accesses information from components and computer systems throughout the center **400** to ascertain the dynamic operating conditions of the center **400**. Thus, the Intervention Manager **460** receives contact center state **432**, agent parameter information, and intervention parameters  
15                   **470** via the contact center network **54**. The Intervention Manager **460** processes this information according to management input **480** using software algorithms to determine parameters for managing the delivery of performance interventions to contact center agents **40**.

                  The Intervention Manager **460** computes the rate of delivering  
20                   performance interventions to agents **40** based on these inputs, **432**, **449**, and **470**, and management input **480**. The number of performance interventions delivered for an increment of time is a function of contact center state **432**. The intervention delivery system **430** implements the delivery of performance interventions according to the rate set by the Intervention Manager **460**.

25                   If contact center state **432** indicates that contact center operations are below a desired level **480**, such as a management input performance target **480**, the Intervention Manager **460** decreases the rate of performance intervention delivery. Decreasing the rate of performance intervention delivery increases the number of agents **40** who are available to service contacts, thereby improving  
30                   operational effectiveness and efficiencies.

If contact center state **432** indicates that the performance of the contact center **400** is higher than required, the Intervention Manager **460** increases the rate of performance intervention delivery, thereby diverting agents **40** from servicing contacts and engaging them to receive performance interventions. In this manner, the contact center **400** enhances the capabilities of its agents **40** without compromising the center's short-term performance.

In addition to setting the rate of performance intervention delivery, the Intervention Manager **460** selects the performance interventions that the performance intervention delivery system **430** delivers to agents **40**. To make the selection, the Intervention Manager **460** compares state **432** of the contact center **400** to intervention parameters **470** and management input **480**. Using contact center state **432** as a factor in selecting interventions provides responsiveness to dynamic conditions in the contact center **400**.

The Intervention Manager **460** computes the selection of performance interventions based on intervention priority, which is an intervention parameter **470**, one or more state levels **480**, which are management inputs **480**, and contact center state **432**, such as operational performance. The Intervention Manager **460** can also select interventions based on other intervention parameters **470**, such as intervention length or intervention cost. Furthermore, the Intervention Manager **460** can select performance interventions that best serve the operational effectiveness of the contact center **400**. For example, the Intervention Manager **460** can select one performance intervention over another intervention based on an estimate that the selected performance intervention will yield more benefit to the contact center **400**.

At any time, the contact center **400** typically maintains a list of performance interventions for which delivery is desirable. The performance interventions in the list have a range of priorities, or importance of delivery. In other words, delivery is critical for certain performance interventions and less important for others.

Intervention priority is typically set by management to define the relative importance or time-sensitive aspects of certain performance interventions relative to other others. For example, in advance of a seasonal sales flurry, such as selling flowers for Valentines Day, management may elect to define a flower-selling instructional session as a critical-priority performance intervention.

If performance **432** of the contact center **400** is lower than desirable, the Intervention Manager **460** can elect to deliver only performance interventions having critical delivery requirements. Consequently, when the contact center **400** is not operating as smoothly as desired, the Intervention Manager **460** avoids unnecessarily diverting an agent **40** from servicing contacts to receiving performance interventions. This function promotes the short-term performance of the contact center **400**. When the contact center **400** is operating better than required, the Intervention Manager **460** is more liberal in its selection of performance interventions.

The contact center performance levels **480** that are thresholds for selecting performance interventions based on priority are management inputs **480**. Personnel in the contact center **400** typically set these levels **480** according to managerial objectives; however, a computer algorithm can also define and/or adjust the state level settings **480**. In other words, either a human or a machine in the contact center **400** can provide management input **480** to the Intervention Manager **460**.

In addition to selecting performance interventions and pacing intervention delivery, the Intervention Manager **460** selects agents to receive performance interventions based on agent need. The Intervention Manager **460** can elect to deliver performance interventions on a priority basis to low-performing agents **40**. Concentrating performance interventions on low-performance agents **40** typically increases the aggregate performance of the agent population **40** more than evenly distributing performance interventions amongst the agent population **40**. That is, the Intervention Manager selects agents **40** to

receive performance interventions to serve the operational goals of the contact center **400** as a whole.

In one embodiment of the present invention, the Intervention Manager's agent selection includes a sequence of agents **40** to receive performance interventions. For example, the sequence follows the ranked order of agent performance, starting with the lowest performing agent **40** and progressively sequencing towards the best performer. The intervention delivery system **430** receives the sequence from the Intervention Manager **460** and delivers performance interventions accordingly.

Those skilled in the information-technology, computing, or contact center arts will recognize that the components, data, and functions that are illustrated as individual blocks in Figure 4 and discussed above are not necessarily well defined modules. Furthermore, the contents of each block are not necessarily positioned in one physical location of the contact center **400**. In one embodiment of the present invention, the blocks represent virtual modules, and the components, data, and functions are physically dispersed. For example, in one embodiment of the present invention, the contact center state **432**, the agent parameters **450**, the agent availability data **435**, the agent schedules **440**, and the intervention parameters **470** are all stored on a single computer readable medium that can be offsite of the contact center **400** and accessed via a WAN.

In one embodiment of the present invention all of the computations and algorithms related to managing performance intervention delivery are stored on a single computer readable medium and executed by a single microprocessor. In yet another embodiment, multiple contact center components each execute one or more steps in the intervention management process. In general, the present invention can include processes and elements that are either dispersed or centralized according to techniques known in the computing and information-technology arts.

The present invention includes multiple computer programs which embody the functions described herein and illustrated in the exemplary flow

charts and graphs and diagrams of Figures 5-15. However, it should be apparent that there could be many different ways of implementing the invention in computer programming, and the invention should not be construed as limited to any one set of computer program instructions. Further, a skilled programmer  
5 would be able to write such a computer program to implement the disclosed invention without difficulty based on the exemplary data tables and flow charts and associated description in the application text, for example.

Therefore, disclosure of a particular set of program code instructions is not considered necessary for an adequate understanding of how to  
10 make and use the invention. The inventive functionality of the claimed computer program will be explained in more detail in the following description in conjunction with the remaining figures illustrating the functions and program flow.

Certain steps in the processes described below must naturally  
15 precede others for the present invention to function as described. However, the present invention is not limited to the order of the steps described if such order or sequence does not alter the functionality of the present invention. That is, it is recognized that some steps may be performed before or after other steps or in parallel with other steps without departing from the scope and spirit of the present  
20 invention.

Figure 5A illustrates primary inputs and primary outputs of an Intervention Manager 460 according to one exemplary embodiment of the present invention. Contact center state 432, intervention parameters 470, and agent parameters 450 are primary inputs to the Intervention Manager 460. The  
25 Intervention Manager 460 processes these three primary inputs, 432, 450, and 470, to provide three primary output parameters, 510, 520, and 530, to the intervention delivery system 430, which responds accordingly. In other words, the Intervention Manager 460 controls performance intervention delivery by outputting controlling inputs 510, 520, 530 to the intervention delivery system  
30 430. The primary inputs, 432, 470, and 450, and the primary outputs, 510, 520,

and 530, of the Intervention Manager 460 can each be a single value or an array of values, such as a vector or a matrix of numbers.

Contact center state 432, the first of the three primary inputs 432, 470, 150 to the Intervention Manager 460, is a measurement of operational performance in the contact center 400, according to one embodiment of the present invention. Exemplary performance metrics include average wait time and percentage of calls connected to an agent 40 within a preset period of time, such as twenty seconds. In another embodiment of the present invention, contact center state 432 is a measurement of load, or call volume.

Intervention parameters 470, the second of the three primary inputs to the Intervention Manager 460, are attributes of each performance intervention that are pertinent to intervention delivery. In one embodiment of the present invention, the priority of each performance intervention is the intervention parameter 470 that the Intervention Manager 460 uses for its output computations. That is, a performance intervention's priority designates the importance of delivering that intervention, and the Intervention Manager 460 manages intervention delivery based on that priority designation.

Priority categories, such as critical, high, medium, and low categories, designate performance interventions with similar delivery importance. Alternatively, the contact center's management prioritizes performance interventions by ranking each performance intervention according to the relative importance of its delivery. An index value can represent this ranking. In one embodiment of the present invention, a continuous scale specifies the priority of each performance intervention.

In addition to priority, intervention parameters 470 can include performance interventions assignments, intervention content, and intervention length. For example, management may assign performance interventions to specific agents 40. Intervention content can include the subject matter of a training session, such as instructing agents 40 to sell roses to contacts who are placing incoming calls to the contact center 400 during the Valentines season.

Agent parameters **450**, the third of three primary inputs **432**, **470**, **450** to the Intervention Manager **460**, includes the aspects of each agent **40** that are pertinent to performance intervention delivery. Agent parameters **450** include agent performance. In one embodiment of the present invention, agent performance includes each agent's ranked performance. That is each agent **40** is assigned a number that ranks his/her ordered performance, spanning from best to worst. Agent parameters **450** also include a list of the performance interventions that each agent **40** has previously received. In one embodiment of the present invention, agent parameters can also include each agent's work schedule **440**, which is available from the WFM component **48**. Agent parameters **450** can also include skills and competencies and traits.

Rate of performance intervention delivery **510**, the first of the three primary outputs from the Intervention Manager **460**, is the number of performance interventions delivered over an arbitrary increment of time, such as per second, minute, hour, day, or shift. This primary output **510** sets the frequency with which the intervention delivery system **430** delivers performance interventions. The rate of performance intervention delivery **510** measures the number of performance interventions for which delivery is initiated. Alternatively, the rate of performance intervention delivery **510** measures the number of performance interventions completed.

Intervention selection **520**, the second of the three primary outputs from the Intervention Manager **460**, is the determination of which performance interventions are delivered by the intervention delivery system **430** to at least one agent **40**. In one embodiment of the present invention, performance intervention selection **520** is a subset of performance interventions assigned for delivery by management of the contact center **400**. In one embodiment of the present invention, intervention selection **520** specifies a group of performance interventions, such as a prioritization category. That is, intervention selection **520** can instruct the intervention delivery system **430** to select a critical, a high, a medium, or a low priority performance intervention for delivery. Furthermore, an

intervention selection **520** can specify that the intervention delivery system **430** is to deliver multiple performance interventions that have a defined combination of priorities.

Agent selection **530**, the third of the three primary outputs from the Intervention Manager **460**, is the determination of the agents **40** to whom the intervention delivery system **430** delivers performance interventions. In one embodiment of the present invention, agent selection **530** is an ordered sequence of agents **40**. Agent selection can also be based on a worst-to-best ordered ranking of agents, the time lapse since each agent received a performance intervention, or the ages of performance intervention assignments. For example, an agent **40** who was assigned a performance intervention several weeks earlier can receive his/her performance intervention rather than another agent **40** who received the performance intervention a few hours earlier.

The Intervention Manager **460** also includes provisions to accept management inputs **480**. Management inputs **480** are settings that adjust the Intervention Manager's computations and algorithms. That is, management input **480** is a vehicle to modify or define the functional relationships between the primary inputs **432**, **470**, **450** and the primary outputs **510**, **520**, **530** of the Intervention Manager **460**. In one embodiment of the present invention, the contact center's personnel enter the management inputs **480** through a computer terminal. In another embodiment of the present invention, one or more of the contact center's computer-based systems automatically compute and provide the management input **480** to the Intervention Manager **460**.

In one embodiment of the present invention, management input **480** is a contact center state level **480**. The Intervention Manager **460** compares the primary input contact center state **432** to the contact center state level **480** and adjusts at least one of the primary outputs **510**, **520**, **530** on the basis of the comparison.

Figure 5B illustrates functional relationships between the three primary inputs **432**, **470**, **450** and the three primary outputs **510**, **520**, **530** of the



Intervention Manager 460 according to one embodiment of the present invention. Function F1 550, Function F2 560, and Function F3 570 describe the algorithms through which the Intervention Manager 460 computes intervention delivery parameters 510, 520, 530, which are output to the intervention delivery system  
5 430.

As illustrated in Figure 5B, the Intervention Manager 460 computes the rate of performance intervention delivery 510 on the basis of contact center state 432 using Function F1 550. That is, contact center state 432 is the primary input variable that algorithm F1 550 uses to compute the rate of  
10 performance intervention delivery 510. Management input 480 is another input to the F1 algorithm 550. Contact center personnel can enter a contact center state level 480 into the Intervention Manager 460 as management input 480. Algorithm F1 550 increases the rate 510 of performance intervention delivery 510 when measured contact center state 432 falls below the state level 480 and decreases the  
15 rate 510 when measured state 432 rises above the state level 480.

Function F2 560 computes the selection 520 of performance interventions based on contact center state 432 and intervention parameters 470. According to an exemplary embodiment of the present invention, this function 560 is an algorithm 560 that compares the state 432 of the contact center 400 to  
20 one or more state levels 480, which are management inputs 480. The algorithm 560 applies rules to the results of the comparison to determine the characteristics of the performance interventions that are to be delivered to agents 40. To select specific performance interventions with these characteristics, the Intervention Manager 460 searches the performance interventions that are eligible for delivery and identifies one or more matches. A performance intervention is typically  
25 eligible for delivery if it is assigned to at least one agent 40.

In an exemplary embodiment, the Function F2 algorithm 560 includes rules that determine a suitable priority 520 of intervention that should be delivered based on the state 432 of the contact center 400. For example, if the  
30 contact center's performance 432 is within a certain performance band 480, the

rules restrict intervention delivery to interventions having a specified priority category that corresponds to the band. Applying the specified priority 520 to the intervention parameters 470 of eligible performance interventions, the algorithm 560 identifies a performance intervention having a suitable priority. The  
5 intervention delivery system 430 then delivers the identified performance intervention to one or more agents 40.

Function F3 570 computes the selection 530 of agents 40 who are to receive performance interventions. In one embodiment of the present invention, the Intervention Manager 460 coordinates selecting agents 40 with  
10 determining intervention delivery rate 510. In another embodiment of the present invention, the Intervention Manager 460 coordinates selecting agents 40 with selecting performance interventions. In yet another embodiment of the present invention, the Intervention Manager 460 coordinates selecting agents both with selecting performance interventions and with determining intervention delivery  
15 rate 510. In other words, the Intervention Manager 460 can coordinate Function F3 370 with Function F2 560, with Function F1 550, or with Function F2 560 and Function F1 550.

To select agents 530 to receive performance interventions, Function F3 570 accesses agent parameters 450 to determine which agents 40  
20 have the greatest need for performance interventions. In one embodiment of the present invention, the Intervention Manager 460 correlates agent need for performance intervention to agent performance. The Intervention Manager 460 ascertains agent performance from the agent performance evaluator or from agent profiles database 449.

25 Figure 5C illustrates the input-to-output functional relationships of the Intervention Manager 460, according to another embodiment of the present invention. In this embodiment, the rate of intervention delivery 510 is a function not only of the contact center state 432, but also of intervention parameters 470, such as intervention priority. In this embodiment, the Intervention Manager 460  
30 can elect to accelerate the delivery of performance interventions when

intervention parameters **470** warrant such accelerated delivery. For example, the contact center **400** may face a deadline to deliver one or more performance interventions that are time sensitive or otherwise critically important. The Intervention Manager **460** can respond to meet the deadline by increasing the  
5 number of performance interventions delivered during a time period preceding the deadline.

Figure 6 illustrates the Intervention Manager **460** adjusting the rate of delivering performance interventions according to one exemplary embodiment of the present invention. The upper graph **610** presents monitored contact center  
10 state **432** and a management-input state level setting **480** over time. In this embodiment, contact center state **432** is contact center performance **432**. In other words, the graph **610** illustrates the measured operational performance **432** of a contact center **40** as compared to a certain level **480**. Without defining a specific metric of contact center performance **432**, this graph **610** illustrates representative  
15 fluctuations of any of the contact center performance variables described herein. Furthermore, the upper graph **610** also illustrates contact center performance **432** responding to intervention delivery by the intervention delivery system **430** under management by the Intervention Manager **460**.

The lower graph **620** illustrates the rate of intervention delivery  
20 **510** as set by the Intervention Manager **460** in response to the conditions illustrated in the upper graph **610**. In other words, the lower graph **620** depicts the Intervention Manager **460** adjusting the rate of intervention delivery based on the monitored performance **432** of the contact center **400**.

Together, the two graphs **610**, **620** illustrate the interaction between  
25 the Intervention Manager **460** and the operating conditions **432** of the contact center **400**, wherein operating conditions **432** are characterized by contact center state **432**. That is, the graphs **610**, **620** illustrate an exemplary sequence of actions and reactions between the Intervention Manager **460** and the operations of the contact center **400**.

In one embodiment of the present invention, the Intervention Manager 460 controls the performance 432 of the contact center 400 with closed loop control using monitored performance 432 as feedback for adjusting the rate 510 of intervention delivery. That is, in one embodiment, the present invention  
5 monitors the current performance 432 of the contact center 400 and dynamically manipulates the number 510 of performance interventions delivered in an increment of time so as to control performance 432 to a desired level 480.

At the time period 630 between  $t_1$  and  $t_2$ , contact center performance 432 is significantly above a performance level setting 480, which is a  
10 management input 480. These conditions suit the delivery of performance interventions, since at least some agents 40 can be diverted from servicing contacts while maintaining acceptable contact center performance 432. At time  $t_2$ , the Intervention Manager 460 elects to initiate delivering performance interventions. Manual intervention by contact center personnel, such as by an  
15 administrator or a manager, can prompt this initiation. Alternatively, either the Intervention Manager 460 or another computer-based system in the contact center 400 can trigger the delivery of performance interventions at time  $t_2$ .

At time  $t_2$ , the Intervention Manager 460 begins ramping the rate 550 of delivering performance interventions. That is, in the time period 640  
20 between time  $t_2$  and time  $t_3$ , the Intervention Manager 460 progressively increases the number 510 of interventions delivered per increment of time from zero upward. As agents 40 suspend servicing contacts and begin receiving performance interventions, monitored contact center performance 432 declines and ultimately falls below the management input state level setting 480.

25 At time  $t_3$ , the Intervention Manager 460 determines that contact center state 432 has fallen unacceptably below the state level setting 480 and ceases delivering performance interventions. In one embodiment of the present invention, ceasing delivering performance interventions entails terminating performance interventions that are in progress. Such termination can follow a  
30 specific agent sequence. The agent termination sequence can proceed according

to management input, last-in-first-out, first-in-last-out, worst-agent-to-best-agent, time since last performance intervention, or other formula. In an alternative embodiment, ceasing initiating new performance interventions curtails the rate 550 of intervention delivery, for example smoothly decreasing the rate of  
5 delivering performance interventions until contact center state 432 recovers to an acceptable level 480.

At time  $t_3$ , the rate 510 of performance delivery is higher than the current conditions of the contact center 400 can support while maintaining an acceptable level 480 of operational performance. One or multiple factors can  
10 contribute to such unacceptable operational performance at time  $t_3$ . For example, an unexpected spike in call volume during the time frame 640 might cause hold time to increase unacceptably. A random increase in the length of time required to service contacts during the time frame 640 might cause wait time to increase, even with constant call volume. Even with constant contact center conditions  
15 during the time frame 640, the Intervention Manager 640 increasing the deliver rate 510 too aggressively might cause unacceptable performance.

Regardless of the cause of the unacceptable performance, the graphs 610, 620 illustrate the Intervention Manager 640 adapting to unacceptable performance and implementing corrective action by changing the rate 510 of  
20 delivering performance interventions to zero at time  $t_3$ .

During the time period 650 between time  $t_3$  and time  $t_4$ , performance 432 of the contact center 400 recovers as the center's operations respond to the Intervention Manager 460 reducing the rate 510 of intervention delivery. After the Intervention Manager 460 changes the rate 432 to zero at  $t_3$ ,  
25 performance 432 continues to decline before peaking at a minimum value and then improving. The time delay between setting the rate 510 to zero and the state 432 recovering may be due to interventions that are already in the delivery pipeline at time  $t_3$ .

At time  $t_4$ , contact center performance 432 is improving strongly  
30 towards passing the state level setting 480. At this point, the Intervention

Manager 460 elects to reinitiate delivering performance interventions. During the time period 660 between time  $t_4$  and time  $t_5$ , the Intervention Manager 460 ramps the rate 510 of delivering performance interventions more gradually than during the time period 640 between  $t_2$  and  $t_3$ . This adjustment of the ramp slope  
5 illustrates the Intervention Manager 460 adapting to the fluctuations in the dynamic responsiveness of the contact center 400.

At time  $t_5$ , the Intervention Manager 460 elects to deliver interventions at a constant rate. At the time period 670 between  $t_5$  and  $t_6$ , contact center performance peaks and then begins to decline. By time  $t_6$ , performance 432  
10 approaches the state level setting 480. At this point, the Intervention Manager 460 begins to taper off the rate 510 of intervention delivery.

The rate reduction continues during the time period 680 between time  $t_6$  and time  $t_7$ . At time  $t_7$ , the Intervention Manager 460 determines that the rate reduction is insufficient to maintain desired performance and sets the rate 510  
15 to zero. The insufficiency of the prescribed rate reduction might result from a perturbation in the number of incoming calls, for example.

During the time period 690 between time  $t_7$  and time  $t_8$ , contact center performance 432 increases above the state level setting 480. At time  $t_8$ , the Intervention Manager 460 resumes delivering performance interventions. In one  
20 embodiment of the present invention, the Intervention Manager's algorithms 550 compute this rate 510 based on the contact center's response to previous rates 510. In other words, the Intervention Manager 460 can analyze and learn from the reactions of the contact center 400 to earlier performance intervention deliveries.

In the time 695 following time  $t_8$ , the Intervention Manager 460  
25 delivers interventions at a constant rate 510. The performance 432 of the contact center 400 stabilizes to a level that is slightly above the state level setting 480. As conditions in the contact center 400 fluctuate beyond time  $t_8$  and as managers update management inputs 480, the Intervention Manager 460 continues to adapt and respond accordingly. This flexible functionality serves both the need to

maintain operational performance at an acceptable level and the need to enhance the performance capabilities of the contact center's staff of agents 40.

Figures 7A and 7B further illustrate the capabilities of the Intervention Manager 460 to adapt to changing conditions in the contact center 400 and to flexibly manage intervention delivery. These figures describe an embodiment of the present invention in which the Intervention Manager 460 manages intervention delivery based on forecasted contact center state 432.

Figure 7A is a graph 700 that illustrates a projected state 432 of the contact center 400 from a current time, at hour zero, to eleven hours into the future. In this example, state 432 is average wait time, which is a performance metric that is typically a function of call volume. The graph 700 also presents a target state level 480, which is typically established through management input 480 and is set to the exemplary value of fifteen seconds. The target state level 480 is the level below which it is desirable to maintain average wait time. In other words, from a performance perspective, less wait time is better, and the Intervention Manager 460 controls intervention delivery so that wait time is less than fifteen seconds.

The illustrated forecast 730 of average wait time 432 is a raw forecast that does not include any change in average wait time 432 that may result from the delivery of interventions under management of the Intervention Manager 460. The forecast includes a time between hour one and hour seven during which the forecasted wait time falls significantly below the target level 480 of fifteen seconds. During this time, the Intervention Manager 460 has an opportunity to deliver interventions while maintaining acceptable wait time.

Figure 7B is a graph 720 that presents the actual, monitored wait time 740 in conjunction with the raw wait time forecast 730 and the target wait time level 480 of the graph 700 illustrated in Figure 7A. The combination of curves illustrates the Intervention Manager 480 using the lull in wait time as an opportunity to deliver performance interventions. In addition to establishing a rate 510 of delivering performance interventions, the Intervention Manager 460 can

elect to take other managerial actions that will consume wait time **730**. For example, the Intervention Manager **460** can use the lull as an opportunity to deliver longer performance interventions. Such actions can be taken in separately or in parallel with one another.

5                   Between hours one and two, the Intervention Manager **460** begins delivering performance interventions or implementing other actions that consume the forecasted lull in wait time **730**. Subsequently, the actual, monitored wait time **740** responds to the delivery of interventions and thereby increases. The actual wait time increases from a forecasted wait time **730** of zero seconds to an actual  
10 wait time **740** of approximately twelve seconds, which is acceptably below the target level **480** of fifteen seconds. In anticipation of the forecast rise in wait time that occurs after hour six, the Intervention Manager **460** can stop delivering performance interventions. After the Intervention Manager **460** stops delivering performance interventions, the monitored wait time **740** settles to overlay the  
15 forecast wait time **730** at approximately hour eleven.

                  As an alternative to stopping the delivery of new performance interventions when, at approximately hour six, monitored state **740** increases above the state level setting **480**, the Intervention Manager **460** can opt to continue delivering time-sensitive performance interventions. For example, a critical  
20 performance intervention may need to be delivered before hour eleven. Although actual state **740** is unacceptable at hour seven, the forecast **730** indicates that state **740** will become progressively worse between hour seven and hour eleven. The Intervention Manager **460** can recognize that the conditions for delivery of the time-sensitive performance intervention are better at hour seven than any other  
25 time before hour eleven. In response, the Intervention Manager **460** can act to serve the contact center's operational effectiveness by rapidly delivering the time-sensitive performance interventions at hour seven.

                  Figures 7A and 7B illustrate the capabilities of the present invention to optimize resource utilization in the contact center **400** based on the  
30 forecasted availability of such resources. The depiction of state **432** in these



figures as average wait time **432** is exemplary. In alternate embodiments of the present invention, the state forecast **432** and the state level **480** are direct measurements of call volume or any other form of call center state **432**.

Figure 8 is another graphical illustration of an exemplary embodiment of the Intervention Manager **460** responding to fluctuating conditions in a contact center **400**. The graph **800** presents call center state **432** and rate **510** on a common timeline. In the embodiment supported by the illustrated functionality, state **432** is the percentage of calls connected to an agent **40** within the exemplary time of twenty seconds. Rate **510** is the percentage of pending performance interventions that are delivered in a time increment, such as an hour. In other words, rate **510** is the percentage of interventions that are delivered out of the total interventions that are eligible for delivery and for which delivery is sought.

Before time  $t_a$ , over 80% of the calls connect to an agent **40** within twenty seconds, and the Intervention Manager **460** is not delivering any interventions. At time  $t_a$ , the Intervention Manager **460** begins delivering interventions. Between time  $t_a$  and time  $t_b$ , the Intervention Manager **460** increases the rate **510** of intervention delivery from zero to seven percent. In response, the percentage of calls connected within twenty seconds falls to approximately 55%. At time  $t_b$ , the Intervention Manager **460** stops increasing the rate **510** of intervention delivery and holds it constant at seven percent for some period of time. Responsive to this steady seven-percent rate, the state **432** of the contact center **400** stabilizes to approximately 55%.

Figure 9 graphically illustrates the functionality of the Intervention Manager **460** in selecting interventions based on the state **432** of the contact center **400** in accordance with an exemplary embodiment of the present invention. The illustrated graph **900** presents the percentage of calls connected to an agent **40** within twenty seconds, along an x-axis timeline. This measurement of state **432** can be a monitored value or a forecast. In the plotted time, state **432** transitions from approximately 83% to approximately 47%.

Based on management input 480, the Intervention Manager 460 maintains a table or similar data file that correlates acceptable intervention parameters 470 to state levels 480 defined by management input 480. The figure depicts intervention priority as an exemplary intervention parameter 470.

5           According to the table, the condition of 80% or more calls connected within twenty seconds, which is an exemplary time, satisfies the state-level criterion for delivering interventions having critical, high, medium, or low prioritization. For the time period 930 below time  $t_d$ , state 432 satisfies this criterion, and the Intervention Manager 460 may select a performance intervention  
10   for delivery from any of these prioritization levels if the intervention is assigned to at least one agent 40.

          State 432 between 70% and 80% is the criterion for delivering critical-, high-, and medium-priority interventions. The state during time period 940 between time  $t_d$  and time  $t_e$  satisfies this criterion. State 432 between 60%  
15   and 70% is the criterion for delivering critical-, and high-priority interventions. The contact center 400 meets this criterion between time  $t_e$  and  $t_f$ , and the Intervention Manager 460 may elect to deliver interventions from either prioritization category during this time period 950. The table restricts the Intervention Manager 460 to delivering only critical interventions when state 432  
20   is between 50% and 60%, as exhibited for the time period 960 between time  $t_f$  and time  $t_g$ . When state 432 falls below 50%, as it does after time  $t_g$ , the Intervention Manager 460 refrains from delivering interventions.

          Figure 10 illustrates an exemplary process for implementing the Intervention Manager 460 in accordance with an exemplary embodiment of the  
25   present invention. Algorithm 1000, titled Intervention Manager Algorithm, computes intervention delivery rate 510, intervention selection 520, and agent selection 530 as a function of contact center state 432, intervention parameters 470, agent parameters 450, and management input 480. Algorithm 1000 incorporates Function F1 550, Function F2 560, and Function F3 570, which are  
30   described above, to perform the computations. The Intervention Manager 460

provides the results of its computations to the intervention delivery system **430**, which delivers interventions following these results.

The first step **1020** of the Intervention Manager Algorithm **1000** is a process **1020**, titled Compute Rate and Selection, that includes Function F1 **550** and Function F2 **560**, which are algorithms illustrated in subsequent figures. Compute Rate and Selection **1020** receives contact center state **432**, intervention parameters **470**, and performance level settings **480** via the contact center network **54** and uses these inputs **432**, **470**, **480** to compute the rate **510** of intervention delivery and the selection **520** of interventions. Function F1 **550** is an algorithm, titled Set Delivery Rate, that computes the rate **550** of intervention delivery using the inputs **432**, **470**, **480**. Function 2 **560** is another algorithm, titled Select Intervention, that computes the selection of interventions using the inputs **432**, **470**, **480**.

The next step of Algorithm **1000** is an algorithm **570** titled Sequence Agents that selects **530** agents **40** to receive performance interventions. The Sequence Agents algorithm **570** computes the selection using agent performance and intervention assignment, which are agent parameters **450**, that are typically stored in the agent profiles database **449**. The selection computation illustrated in Figure 10 is an exemplary implementation of Function F3 **570** illustrated in Figures 5A, B, and C and described above.

At Step **1030** of Algorithm **1000**, the Intervention Manager **460** interacts with the intervention delivery system **430** to deliver interventions to the agents **40** selected in Sequence Agents **570**. Deliver Intervention Algorithm **1030**, which is illustrated in subsequent Figure 14, includes functionality that communicates the status of the contact center's agents **40** to other personnel and systems in the contact center **400**. Such communication supports coordinating processes in the contact center **400** to enhance operational efficiency of the center **400**.

Following Step **1030**, Algorithm **1000** calls Control Intervention Delivery **1040**, which facilitates the Intervention Manager **460** interacting with the

intervention delivery system while intervention delivery is underway. Through Algorithm 1040, the Intervention Manager 460 can elect to terminate intervention delivery if dynamic conditions in the contact center 400 warrant such termination. For example, if contact center performance 432 dips to an unacceptable level,  
5 Algorithm 1040 terminates intervention delivery so that additional agents 40 can service contacts and improve performance 432.

At decision Step 1050, the Intervention Manager Algorithm 100 iterates the previous steps in the algorithm flow for each agent 40 of the contact center 400 for whom intervention delivery is applicable. That is, Algorithm 1000  
10 continuously repeats unless all pending interventions have been delivered to all eligible agents 40.

Figure 11 is a flowchart 550 illustrating the flow and steps of an exemplary embodiment of the Set Delivery Rate Algorithm 550 presented in Figure 10. The Intervention Manager Algorithm 1000 calls Algorithm 550 as part  
15 of its Compute Rate and Selection process 1020. Algorithm 550, as illustrated is Figure 11, is also an embodiment of the F1 Function 550 depicted in Figure 5B.

Exemplary algorithm 550 begins with receiving contact center state 432 in the form of contact center performance 432 and management input 480 in the form of a state level setting 480. In the exemplary algorithm 550, the state  
20 level setting 480 is a performance level setting 480. In other embodiments of the present invention, Set Delivery Rate Algorithm 550 uses any of the forms of contact center state 432 and state level settings 480 discussed herein.

At inquiry Step 1120, Algorithm 550 determines if contact center performance 432 is above or below the performance level setting 480. That is, the  
25 Intervention Manager 460 determines if the performance 432 of the contact center 400 is suitable to deliver performance interventions at a certain rate 510.

If performance 432 is above the state level setting 480, then at Step 1140, the Intervention Manager 460 instructs the intervention delivery system 430 to increase the rate 510 of delivering performance interventions. If performance  
30 432 is below the state level setting 480, then at Step 1130, the Intervention

Manager 460 notifies the intervention delivery system 430 to reduce the rate 510 of delivering performance interventions.

In one embodiment of the present invention, Algorithm 550 includes multiple performance level settings 480, each triggering a distinct rate 510. In one embodiment of the present invention, rate 510 is a function of the difference between the contact center performance 432 and a performance level setting 480. The computed rate 510 is related to the deviation between performance 432 and performance level setting 480. The algorithm 550 computes a specific rate 510 that is proportional to the magnitude of the difference between performance 432 and performance level setting 480.

In one embodiment of the present invention, the Intervention Manager 460 adjusts the performance level setting 480 to meet an intervention delivery goal of the contact center's management or other decision maker. In one embodiment, the Intervention Manager 460 notifies management if the current rate 510 of intervention delivery is insufficient to meet a managerial goal or deadline. If current constraints preclude delivering any performance interventions, then the Intervention Manager 460 notifies management that the performance level setting 480 needs adjustment, for example. In one embodiment of the present invention, the Intervention Manager 460 can elect to automatically adjust the performance level setting 480.

In one embodiment of the present invention, the Intervention Manager 460 computes intervention delivery rate 510 based on one or more intervention parameters 470. Figure 5C, which is discussed above, illustrates an embodiment in which Function F1 550 of the Intervention Manager 460 computes rate 510 on the basis of contact center state 432, management input 480, and intervention parameters 470.

For an embodiment as illustrated in Figure 5C, priority of intervention delivery is an intervention parameter 470 that affects the determination of delivery rate 510. The Intervention Manager 460 can take measures to expedite the delivery of critical priority interventions. For example,

the Intervention Manager **460** can accelerate intervention delivery when the intervention profiles database **449** specifies that specific performance interventions have critical delivery requirements.

5 In one embodiment of the present invention, management can enter, as management input **480**, a deadline to deliver one or more specific performance interventions. The Intervention Manager **460** monitors progress towards meeting the deadline. If, as the deadline approaches, the Intervention Manager **460** determines that the existing rate **510** of intervention delivery is insufficient to meet the deadline, then the Intervention Manager **460** increases the  
10 rate **510** of intervention delivery.

Referring now to Figure 12, after the Intervention Manager Algorithm **1000** determines the rate **510** of intervention delivery, it calls Select Intervention Algorithm **560** to select one or more specific performance interventions for delivery. Algorithm **560** is an exemplary embodiment of  
15 Function F2 **560**, which is depicted in Figure 5B and Figure 5C. The flowchart **560** includes logic and computations that implement the functionality illustrated in Figure 9. That is, Figure 12 illustrates the algorithms behind the functionality depicted in Figure 9 and is generally consistent with Figures 5B and 5C.

Algorithm **560** performs the intervention selection **520** on the basis  
20 of performance level settings **480**, contact center performance **432**, and intervention prioritization. This data **480**, **432**, and **470** is available from management input **480**, the ACD **32**, and intervention profiles database **469** respectively.

At inquiry Step **1220**, Algorithm **560** determines if contact center  
25 performance **432** is above a management input performance level setting **480**. More specifically, Step **1220** determines if more that 80% of the calls into the contact center **400** are connected to an agent **40** within twenty seconds, which is an exemplary time. If the determination is positive, at Step **1225** Algorithm **560** selects a performance intervention having a critical, high, medium, or low  
30 categorization. In other words, when contact center performance **432** is at its

highest level, performance intervention selection **560** is not constrained to a specific intervention priority. At this performance, the Intervention Manager **460** can elect to deliver any performance intervention that is assigned to at least one agent **40**.

5                   At inquiry Steps **1230**, **1240**, and **1250**, Algorithm **560** determines if contact center performance **432** is between 80% and 70%, between 70% and 60%, or between 60% and 50% respectively. If performance **432** is less than or equal to 80% and greater than 70%, Select Intervention **560** executes Step **1235** to select a critical-, high-, or medium-category performance intervention.

10           Performance **432** less than or equal to 70% and greater than 60% is the criterion for Algorithm **560** to select a performance intervention from the critical and high categories of performance interventions. For performance less than or equal to 60% and greater than 50%, Step **1255** limits the Intervention Manager **460** to selecting performance interventions that are designated as critical. If the contact

15           center **400** connects 50% or fewer calls to an agent **40** within twenty seconds, then, at Step **1260**, Algorithm **560** does not select any performance interventions for delivery until performance **432** improves.

                  If Algorithm **560** determines that the performance **432** of the contact center **400** is such that multiple performance interventions meet the

20           selection criterion and thus qualify for delivery, then the Intervention Manager **460** can select one or more specific interventions from the qualifying group. That is, of the performance interventions that are assigned to at least one agent **40** two or more may qualify for delivery based on the criteria of Algorithm **560**.

                  In one embodiment of the present invention, the Intervention

25           Manager **460** randomly selects one of the performance interventions from the group of qualifying interventions. In another embodiment of the present invention, input from a manager of the contact center **400** narrows the choices of performance interventions. In yet another embodiment of the present invention, the performance intervention with the highest priority is selected.

In another embodiment of the present invention, Algorithm 560 offers an agent 40 a menu of performance interventions from which the agent 40 can select one or more specific interventions. The menu can include performance interventions having various priorities, for example several high-priority  
5 interventions and low-priority interventions. The menu can provide an indication of priority as well as any approaching deadlines for completing time-sensitive interventions.

Turning now to Figure 13, after the Intervention Manager Algorithm 1000 determines the rate 510 of intervention delivery and the selection  
10 520 of performance interventions, Algorithm 570 makes a selection 530 of one or more agents 40 to receive a performance intervention. Algorithm 570, which is titled Sequence Agents Algorithm, is an exemplary embodiment of Function F3 570 as illustrated in Figure 5B and Figure 5C. The agent profiles database 449 supplies Algorithm 570 with the performance of the agents 40 in the contact  
15 center 400 who are eligible to receive performance interventions. The database 449 also provides the algorithm 570 with the performance interventions that are assigned to each of these agents 40.

At Step 1320, Algorithm 570 uses agent parameters data 450 from the agent profiles database 449 to select the lowest performing agent 40 as the  
20 next agent 40 to receive a performance intervention. The Intervention Manager 460 notifies the agent delivery system 430 of the selected agent 530 and the performance intervention 520 selected by the Select Intervention Algorithm 560. In compliance with these parameters 520, 530 and a delivery rate 510, the intervention delivery system 430 delivers the selected performance intervention  
25 520 to the selected agent 530.

In one embodiment of the present invention, the agent profiles database 449 includes a ranking of the relative performance of each agent 40 who is eligible to receive an intervention. That is, the contact center 400 maintains a list of agents 40 ordered by performance, from the best performing agent 40 to the  
30 worst performing agent 40. The Intervention Manager 460 uses the ranked order



to compose a sequence of agents **40** to receive performance interventions. The sequence starts with the lowest performing agent **40** and sequentially progresses to higher performing agents **40**. In one embodiment of Algorithm 570, Step 1320 proceeds from the lowest rank agent **40** who has an assigned performance  
5 intervention. In one embodiment of the present invention, managerial personnel in the contact center **400** can specify specific agents **40** to receive performance interventions, for example overriding a computer-generated sequence.

Those skilled in the art appreciate that the present invention supports a wide range of methodologies for identifying a single agent **40** or a  
10 sequence of agents **40** to receive a performance intervention. For example, at Step **1320** in Algorithm **570**, the Intervention Manager **460** can elect to select an agent **40** who is average performer, but has an assignment with a rapidly approaching deadline.

Turning now to Figure 14, an exemplary embodiment of the  
15 Deliver Intervention Algorithm **1030** is illustrated. Deliver Intervention Algorithm **1030** communicates agent status information to systems in the contact center **400** to facilitate coordinated interactions between these systems and the contact center's agents **40**. At the top of the flowchart **1030**, the Intervention Manager **460** provides Algorithm **1030** with data specifying the next agent **40**  
20 selected to receive a performance intervention.

At inquiry Step **1410**, Algorithm **1030** determines if the selected agent **40** is either on break or is scheduled to be on break within a set period of time. In one embodiment of the present invention, the set period of time is one hour. In another embodiment of the present invention, the set period of time is a  
25 multiple of the length of the performance intervention.

If the selected agent **40** is not on break, then Algorithm **1030** executes inquiry Step **1420** to determine if the selected agent **40** is logged onto a terminal **44**. Algorithm **1030** executes Step **1430** if the selected agent **40** is on break, scheduled to be on break within a short period of time, or is not logged onto  
30 a terminal **44**. In Step **1430**, Algorithm **1030** notifies the Intervention Manager

**460** to reschedule the performance intervention based on the selected agent's lack of availability to receive the intervention.

If at inquiry Step **1420** Algorithm **1030** determines that the selected agent **40** is free from breaks and is logged onto an agent terminal **44**, then the  
5 algorithm **1030** acquires the agent availability status **435** from the ACD **32**. Using this availability status **435**, inquiry Step **1440** determines if the selected agent **40** is currently servicing a contact.

If the selected agent is not servicing a contact, then at Step **1460**  
10 the Intervention Manager **460** notifies the ACD **32** to log the agent **40** off from servicing contacts so the agent **40** is prepared to receive the intervention. If the selected agent **40** is servicing a contact, then at Step **1450** the Intervention Manager **460** waits until the agent **40** completes servicing the current contact and then notifies the ACD **32** to log the agent **40** off from contact-service duties.

At Step **1470**, the ACD **32** has suspended the agent's contact  
15 servicing activities and the agent **40** is prepared to receive the performance intervention. At this point, the Intervention Manager **460** notifies the intervention delivery system **430** to commence delivering the performance intervention to the selected agent **40**. When the notification is successful, Algorithm **1030** ends and the process of controlling intervention delivery **1040** begins.

20 In one embodiment of the present invention, the log-off process from the ACD **32** is a manual process. That is, rather than automatically or unilaterally logging off the agent **40** from his/her terminal **44**, the process requires manual intervention by the agent **40**. In this manner, the agent **40** may opt to not log off and accept a performance intervention; rather, the agent **40** may choose to  
25 continue servicing contacts or engage in another discretionary activity. Also, the agent's interaction with the ACD **32** can include the agent **40** notifying the ACD **32** of his/her availability to receive a performance intervention. That is, the agent **40** can send notification that he or she is amenable to a performance intervention at a specific time that can be defined by the Intervention Manager **460**.

In one embodiment of the present invention an agent **40** can, when prompted to receive a performance intervention, delay delivery for a predetermined length of time, such as ten minutes. After the predetermined length of time has lapsed, the agent **40** can receive another request to accept a performance intervention. The agent **40** can respond by again delaying delivery. The cycle can repeat indefinitely or alternatively can terminate after a specified number of iterations.

Figure 15 is a flowchart that illustrates an exemplary embodiment of Algorithm **1040**, titled Control Intervention Delivery Algorithm, which initiates after Algorithm **1030**. Monitored contact center performance **432** and management input performance level **480** are two inputs to the exemplary embodiment of Algorithm **1040**. At inquiry Step **1510**, Algorithm **1040** determines if the monitored performance **432** is above the performance level setting **480**. If the performance **432** is above the performance level **480**, then the contact center's operational performance is acceptable and the Intervention Manager **460** does not interfere with the intervention delivery system's intervention delivery.

If inquiry Step **1510** determines that monitored performance is unacceptable, then Algorithm **1040** accesses an agent termination order **1530**. In one embodiment of the present invention, the termination order **1530** is a management input **460**. In another embodiment, the termination order **1530** is a random sequence. In yet another embodiment, the termination order **1530** is a derivation of the length of time since each agent **40** has received a performance intervention. For example, the agent **40** who most recently received a performance intervention is the first agent **40** in the termination order **1530**, and the agent **40** who has not received a performance intervention for the longest period of time is the last agent **40** in the termination order **1530**. The agent termination order **1530** can also be based on a rank of agent performance, a last-in-first-out sequence, a first-in-last-out sequence, or another methodology that serves the operational goals of the contact center **400**.

At Step 1540, the Intervention Manager 460 instructs the intervention delivery system 430 to terminate intervention delivery for the first agent 40 on the agent termination order 1530. At Step 1550, the Intervention Manager 460 notifies the ACD 32 to log the terminated agent 40 on a terminal 40  
5 to resume servicing contacts.

After executing either Step 1520 or Step 1550, Algorithm 1040 acquires fresh monitored state data 432 and iterates the process of determining if performance is acceptable and acting on that determination.

Algorithm 1040 supplements the functionality of the previous steps  
10 in the Intervention Manager Algorithm 1000 by providing an increased level of responsiveness to dynamic conditions in the contact center 400. That is, in addition to establishing the parameters 510, 520, 530 of intervention delivery, the Intervention Manager 460 intervenes with the delivery process if conditions in the contact center 400 become unacceptable or otherwise unsuitable for delivering  
15 performance interventions.

An exemplary embodiment of an Intervention Manager Algorithm 1000 has been described in conjunction with exemplary Functions F1, F2, and F3  
20 550, 560, 570. Those skilled in the art recognize that the present invention supports adapting these functions 550, 560, 570, both in functionality and in sequence of implementation, to achieve a wide range of functional objectives and purposes related to managing intervention delivery in a contact center 400.

In summary, the present invention supports managing the rate of delivering performance interventions to agents in a call center to enhance the capabilities of the agent population while maintaining robust performance of the  
25 contact center.

From the foregoing, it will be appreciated that the preferred embodiment of the present invention overcomes the limitations of the prior art. From the description of the preferred embodiment, equivalents of the elements shown therein will suggest themselves to those skilled in the art, and ways of  
30 constructing other embodiments of the present invention will suggest themselves

to practitioners of the art. Therefore, the scope of the present invention is to be limited only by the claims below.